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THE APOLLO-SOYUZ TEST FLIGHT

A.A. Leonov

Translation of "Eksperimental'nyy polet 'Apollo'-'Soyuz'," Zemlya i vselennaya, No. 2, March-April 1974, pp. 13-17

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16. Abstract Cosmonaut A.A. Leonov, designated Soviet crew commander for the ASTP flight, reviews the flight program and relates some of his impressions of the Houston Space Center. The flight mission is to complete rendezvous and docking; the solar eclipse experiment is also mentioned. Leonov briefly compares the Soyuz and Apollo spacecraft, discussing differences in astronaut versus cosmonaut training. He feels some Apollo components are superfluous and that some components are more fully executed on the Soyuz. Further details are not given. This article is based on Leonov's speech at the VII Tsiolkovskiy Lectures, Kaluga, 17 September 1973.

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THE APOLLO-SOYUZ TEST FLIGHT

A.A. Leonov

Nearly 2 years ago the USSR and the United States reached /13* agreements on cooperation in research and the use of space for peaceful purposes. One of the most important tasks of this cooperation is to prepare for the joint flight of the Soyuz and Apollo spacecraft.

The Soviet Union is undertaking a broad program of cooperation with various countries in investigation of space. Thus, an agreement was concluded between the Soviet Union and the United States of America dealing with space research. It was decided to carry out a joint flight of Soviet and American astronauts on the Soyuz and Apollo craft. On 15 July 1975, at 16 hours 32 min 02 sec, the Soviet Soyuz craft will lift off from the launch pad of the Baykonur Cosmodrome. If for some reason it is required to postpone the launch, it will take place not later than 22 September 1975. There will be two more Soyuz craft at the launch sight, ready for a space voyage. Soviet cosmonauts will begin the joint flight, and the Americans will join up to it somewhat later.

After Soyuz has been inserted into Earth orbit, Soviet specialists will determine all its parameters and immediately relay them to the United States, to Cape Kennedy. In 7 hours 30 min after the beginning of the Soyuz flight, with these data the American Apollo will be launched with a crew of three. The Soyuz and Apollo will maneuver for a day and carry out corrections to ensure optimal conditions for closing and docking. On completing the operations of search, closing, and mooring, the ships must be hard-coupled.

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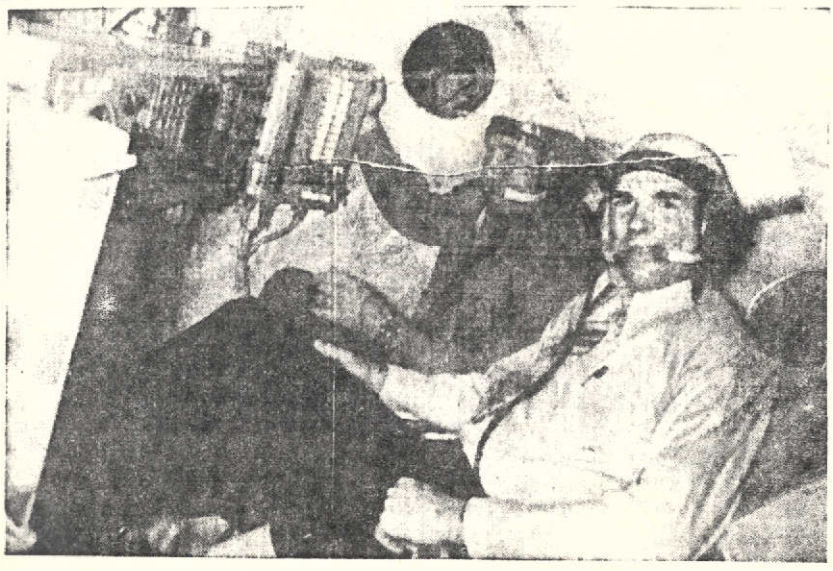
* Numbers in the margin indicate pagination in the foreign text.

As we know, on the Soyuz, Vostok, and Voskhod an atmosphere similar to the Earth's atmosphere is provided (pressure 760 mm Hg, oxygen content 17-33%, nitrogen 82-66%). The maximum air pressure in our craft can be raised to 800 or even 1000 mm Hg. The atmosphere on the American craft Apollo, Gemini, and Mercury is pure oxygen at a pressure of 260 mm Hg. The difference between the atmospheres does not enable cosmonauts to pass directly from a Soviet craft to an American. To overcome this difficulty, two important steps were taken. First, an adapter was developed and built. On entering it, the American astronauts close the hatch to their ship, raise the pressure that would correspond to the pressure in the Soviet craft, and then pass over into it. The ship atmospheres will be virtually unmixed. On the other hand, in order to reduce the pressure drop and facilitate acclimatization of the astronauts on board the Soyuz, the pressure will be lowered about one-third compared to what it was during previous flights. The /14



Soviet cosmonaut Aleksey Leonov and American astronaut David Scott in the Soyuz craft trainer.

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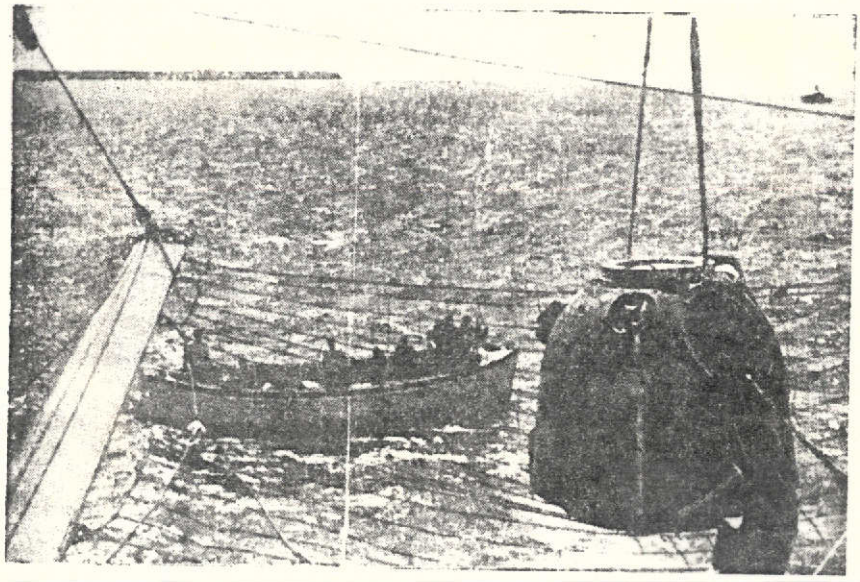

During the preparation for the future joint Soyuz-Apollo flight, training sessions were carried out at sea to work out the possible landing of the landing module in water.

transfer time will take no more than 10 min. In July 1973 in Houston, Soviet and American cosmonauts and astronauts rehearsed this transfer in a trainer and examined the adapters that will link up the ships in space.

The docking collar was built according to a single set of engineering requirements formulated by Soviet and American scientists and has already been built in metal. But each country is building its docking collar with a slight design difference. Our unit will operate with an electric drive, while the analogous American unit is equipped with a hydraulic system. We will see which is better.

The ships will be docked for 2 days. During this time, cosmonauts will pass several times from one craft to another. True, a firm condition was set: there must be simulataneously no more than three persons in each craft.

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The main goal of the joint flight is to find each other in space, close up to the craft, dock, and pass from one ship into another. In addition, photography of the solar corona is provided for. One of the ships will cover the Sun's disk with its hull, while a cosmonaut from the other ship will take several photographs.

The cosmonauts are to observe the action of ionized gases ejected by the other spacecraft on the system of cabin windows and optical instruments, and study the magnetic electric fields by radio probing. During the flight features of the absorption of ultraviolet rays, problems of biological interaction, and the nature of the behavior of microorganisms will be investigated. During the joint flight each crew member will work several times in the other craft. Our cosmonauts will carry out some control of the Apollo and perform scheduled experiments. The American astronauts on the Soyuz will also perform a number of maneuvers and carry out planned assignments. Then the cosmonauts will take their /15 places in their craft, the ships will undock, and the crews will continue their programmed assignments.

The flight will be directed by Pilot-Cosmonaut of the USSR A.S. Yeliseyev and P. Frank (USA). A flight center is being organized in the Moscow area; a similar center was set up by the Americans at Houston. The Apollo crew will be as follows: commander -- General Thomas Stafford, adapter pilot -- Donald Slayton, and pilot of command module -- Vince Brand. Stafford has been on three space flights on the Gemini-6 and Gemini-9 and on Apollo-10. The two other members of the American crew have no space flight experience, although Slayton has long been engaged in space research, and Brand was among the astronauts working under the Skylab program. The backup crew includes Alan Bean, Donald Evans, and James Lousma. Bean flew on the Apollo-12, Evans on Apollo-17, and Lousma on the orbital Skylab station.

I have been given the high honor of commanding the crew of the Soyuz. The flight engineer is V. N. Kubasov. The backup crews include A.V. Filippchenko, N.N. Rukavishnikov, V.A. Dzhanibekov, B.D. Andreyev, Yu.V. Romanenko, and A.S. Ivanchenko.

Six working groups have been set up to solve all the problems that have arisen and that may yet arise. They have many responsibilities. And all questions are equally important -- there will be no secondary, insubstantial items in the orbital flight. As noted by the Chairman of Interkosmos, Academician B.N. Petrov, both the testing of the ship life support systems and, for example, the checkup on the safety of the docking collars locks require equal care.

The Soyuz spacecraft has already been modernized. It remains to draw up a flight program and onboard documentation, to organize cooperation between the control centers, and to carry out joint training of crews.

There is yet another problem that we, as Soviet cosmonauts, just as our American colleagues, regard as very important. This is the language problem. Under the agreement, the crews of the spacecraft must speak equally well in both English and Russian. Experienced instructors were invited to the cosmonaut training center (each instructor works individually with a single cosmonaut). The proposal was made to us that a course of exercises designed for 800 hours be conducted over 10 months. The procedures in the exercises are entirely new. My comrades Romanenko and Dzhanibekov began studying the language half a year earlier than the others, and in my view they are in no wise inferior now than students graduating from a language institute of higher learning. When we were in America, these young cosmonauts got along splendidly without an interpreter and freely talked in English.

It appears to me that it is more difficult for the Americans to master Russian than it is for us to master English. They do not find it easy to distinguish the nouns "zabor" [fence] and "sobor" [cathedral]. Jokingly, the American astronauts have said that we have too many similar sounding words, and even all the railway stations in the USSR sound the same -- "boiling water".

The Americans greeted us very graciously. We inspected the Space Research Center, 40-50 miles from Houston. The Center has a service and a living area, just as in our Star City. True, their builtup areas are dispersed, while ours are more compact. The American astronauts live in separate cottages of varied style and different floor space. I recall when Star City was being laid out, Soviet cosmonauts were suggested to choose the type of residence themselves. We discussed the experience of Akademgorodok in Novosibirsk, where individual cottages had been built, and decided that it would be best to live in a single large house.

We were shown the laboratory, test complexes, and the Apollo spacecraft. Today the U.S. has three Apollos. One of them is already ready for the space flight and is in preservation. I was in it. The explanatory panels and the instructions are in English and Russian. We visited several enterprises where spacecraft are being built and booster vehicles assembled. Our attention was drawn to the organization of the work and the well-laid out procedures at these enterprises. We have something to learn from the Americans and we do not hide this. Equally, the Americans can earn much from us. So the joint flight will bring mutual benefit.

Much can be said about the Apollo, that it includes compo- /17
that are not on the Soyuz, although in our view some components appear to be superfluous. There are items that are better executed on the Soyuz. Evidently, in the future it is worthwhile building a single logical design that would be the basis for a "mixed" type craft.

Soviet cosmonauts Aleksey Leonov and Valeriy Kubasov as guests with their American colleagues (Houston, United States).

The procedures of astronaut training are interestingly structured in America. Television is widely used. Lecture texts are tape-recorded. The astronaut can view and listen to lectures when he needs to. A separate room is provided for each.

In November 1973 we were visited by a group of American astronauts. We arranged lectures for them, as provided by the program, showed films and displayed our equipment. Our American colleagues observed with interest how Soviet cosmonauts engage in sport parachuting. We do this not to attain any sporting records, but to maintain our professional form. We believe that the parachute provides the conditions under which one can seriously test one's

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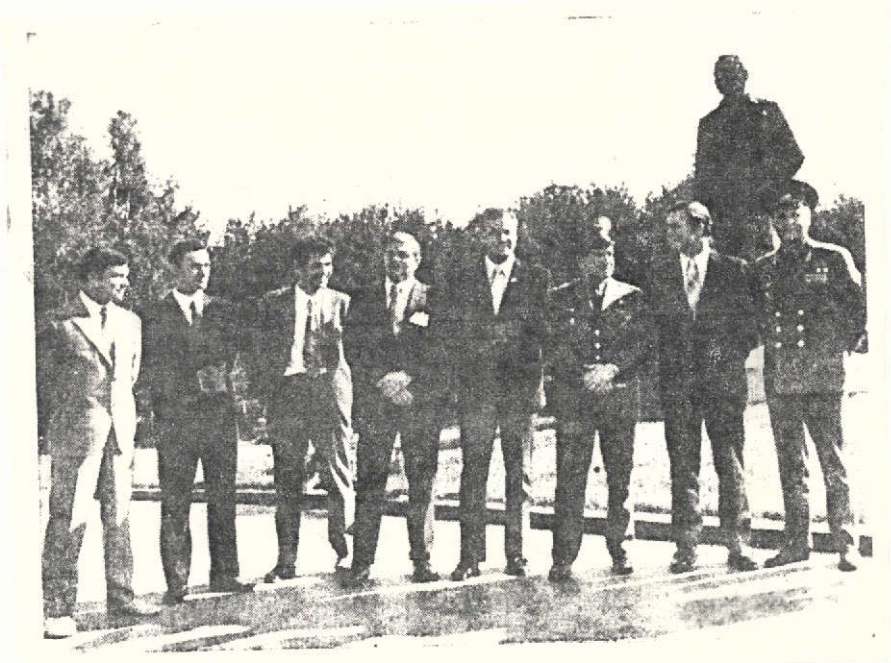

Soviet and American cosmonauts and astronauts by the memorial to Yu. A. Gagarin in Star City. Photo from Novosti Press Agency - TASS.

will, learn to graphically orient oneself, and to instantaneously make decisions in a complicated environment. The Americans do not engage in sport parachuting. I had occasion to hear that they are not overly fond of it and even are rather afraid of it.

The successful preparation and the execution of the Apollo-Soyuz test flight can be the basis for long-term fruitful cooperation between the Soviet Union and the United States. One feature of the flight of the Soviet and American craft is not simply the exchange of experience and achievements, but also the building of new technical facilities existing neither in the United States nor the USSR.

The Soviet Union is the pioneer in space research. An artificial Earth satellite was launched first in the USSR. A Soviet person was the first to step into space. Soviet scientists and designers were the first to build an orbital station. On the other

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hand, a wealth of experience has been accumulated in the United States in the organization and carrying out of manned flights to the Moon and also on the orbital Skylab program. And, doubtless, combining the forces of our countries in the conquest of space will bring outstanding results, which will have great value for the progress of all mankind.